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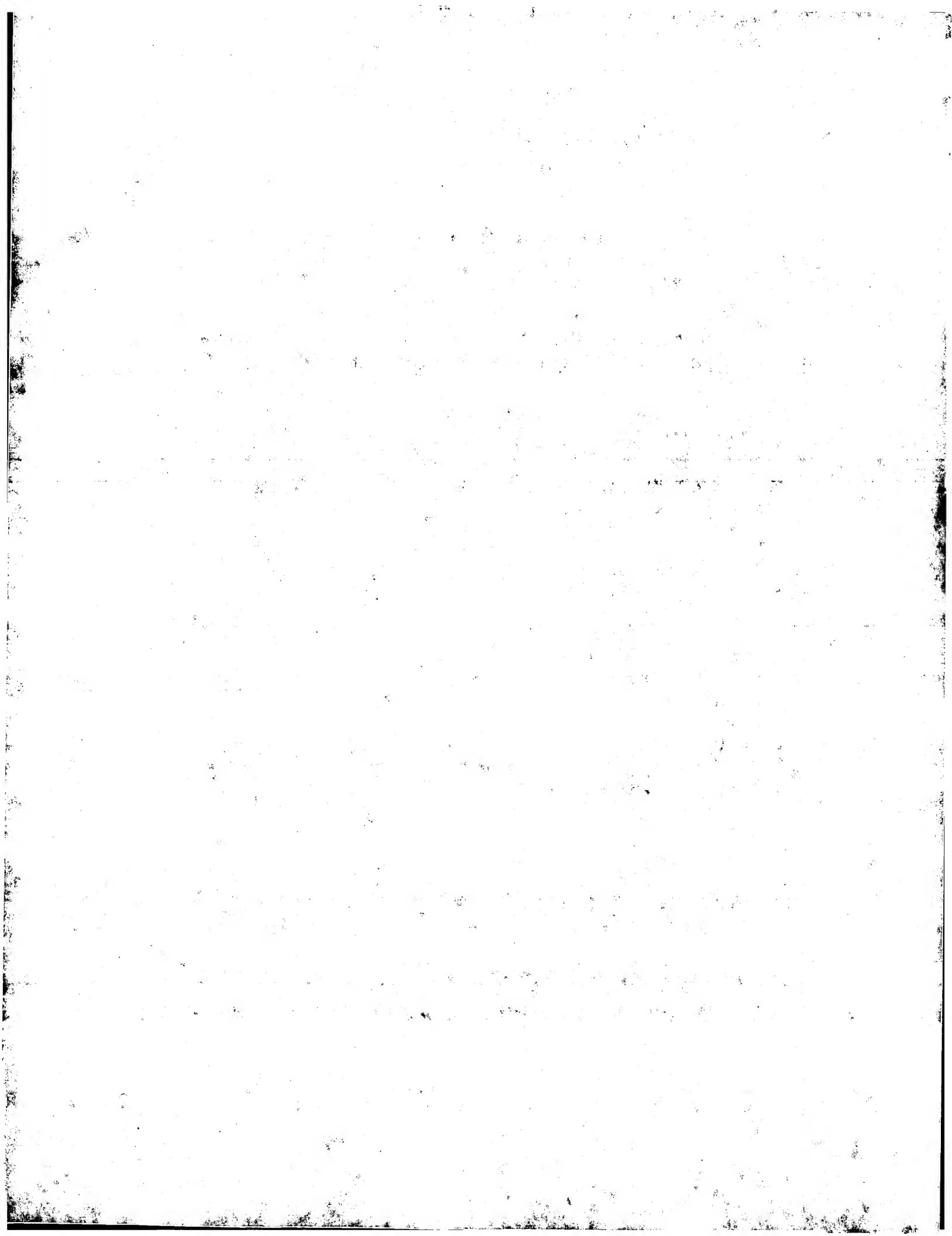
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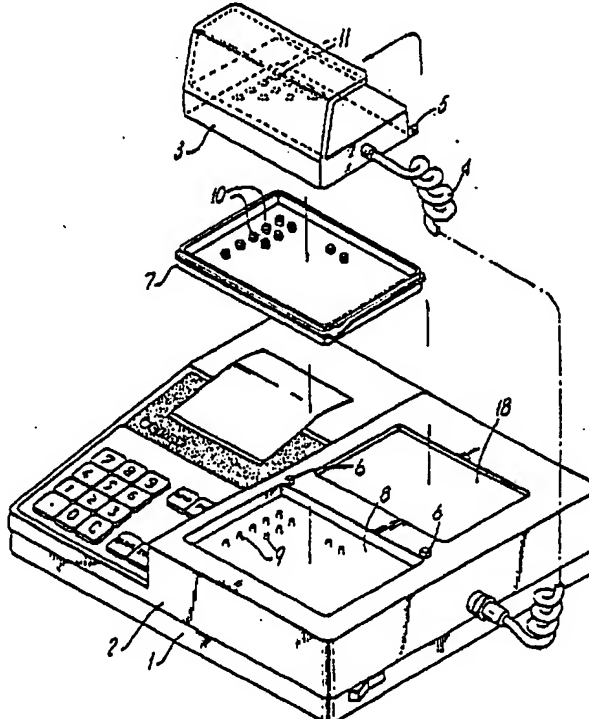


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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>3</sup>: G01N 21/01</p>	<p>A1</p>	<p>(11) International Publication Number: WO 82/00356 (43) International Publication Date: 4 February 1982 (04.02.82)</p>
<p>(21) International Application Number: PCT/FI81/00060 (22) International Filing Date: 24 July 1981 (24.07.81) (31) Priority Application Number: 802342 (32) Priority Date: 24 July 1980 (24.07.80) (33) Priority Country: FI (71) Applicant: LABSYSTEMS OY [FI/FI]; Puititie 9, SF-00810 Helsinki 81 (FI). (72) Inventor: SUOVANIEMI, Osmo; Armas Lindgrenintie 15 A, SF-00570 Helsinki 57 (FI). (74) Agent: PATENTTI- JA INSINÖÖRITOIMISTO RUSKA &amp; CO.; Kauppiaankatu 7 A, SF-00160 Helsinki 16 (FI).</p>		<p>(81) Designated States: AT (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), SE (European patent), SU.  Published <i>With international search report In English translation (filed in Finnish) Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments</i></p>
<p>(54) Title: ANALYZER</p> <p>(57) Abstract</p> <p>An analyzer for the measurement of the properties of reaction mixtures contained in the cuvettes (10) in a set of cuvettes (7) simultaneously out of several cuvettes by means of one or several sources of radiation (9) placed above or underneath the cuvettes and by means of a detector (11) receiving radiation and placed underneath or above each cuvette. The beam of measurement passes substantially in the direction of the vertical axis of the cuvette and the set of cuvettes (7) can be fitted to the apparatus detachably between the source or sources of radiation (9) and the detectors (11), either above the source or sources of radiation or above the detectors. The detectors (11) or the source or sources of radiation (9), respectively, can be shifted or fitted detachably or pivotably to the position of measurement above the set of cuvettes (7).</p> 		

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Analyzer

The present invention is concerned with an analyzer for the measurement of the properties of reaction mixtures contained in the cuvettes in a set of cuvettes simultaneously out of several cuvettes by means of one or several sources of radiation placed above or underneath the cuvettes and by means of a detector receiving radiation and placed underneath or above each cuvette, the beam of measurement passing substantially in the direction of the vertical axis of the cuvette and the set of cuvettes being fitted to the apparatus detachably between the source or sources of radiation and the detectors, either above the source or sources of radiation or above the detectors. The objective of the invention is to provide a compact and simple construction of an analyzer. The analyzer in accordance with the invention is characterized in that either the detectors or the source or sources of radiation, respectively, can be fitted detachably or pivotably to the position of measurement above the set of cuvettes.

By means of the analyzer in accordance with the invention the reaction results can be measured in one wide matrix, e.g., in a cuvette-set matrix (cuvette set) in accordance with two Finnish patent applications "Set of cuvettes" filed simultaneously with the present application, or in any other matrix. The measurement radiation or any other measurable signal, produced for each sample, is passed to each cuvette in the matrix and further to the corresponding detector in the vertical direction by, manually or automatically, first shifting the cuvette-set matrix and then the detector matrix or, when the corresponding detectors are placed underneath the cuvette-set matrix, the measurement-beam matrix corresponding the cuvette-set matrix onto the cuvette-set matrix.

The present invention is particularly well suited for the measurement of a very high number of reac-



tion results under circumstances wherein the volumes of the reaction mixtures are little (e.g., 10 to 50  $\mu$ l), and under these circumstances the cuvettes in the cuvette-set matrixes must also be of a small volume and placed close to each other. Under these circumstances, e.g., photometric measurement is successful only by using the method of vertical measurement applied in the FP-9, FP-901 and Titertek Multiscan analyzers (Suovaniemi, Osmo: "Performance and Properties of the Finnpiquette Analyzer System", Proceedings of the Second National Meeting on Biophysics and Biotechnology in Finland, 183, 1976).

The analyzer to be described now is suitable for methods in which measurements based, e.g., on photometry, spectrophotometry, fluorometry, or turbidometry are used.

The analyzer is highly suitable, e.g., in EIA (enzyme immuno assay) reactions, blood-group serology (e.g. ABO and Rh), in HLA (human leucocyte antigen) serology, in MIC (minimum inhibitory concentration) determinations, like also in other types of ascertaining of the growth or inhibition of growth of micro-organisms, and further in all methods based on the CF (complement fixation) phenomenon.

The following list includes some of the advantages of the present analyzer invention.

1. simple construction
2. quick and easy to operate
3. output in accordance with desired programs
4. small reaction-mixture volumes mean economies both in reagents and in samples
5. electronic control of mechanical components (cuvette and detector matrixes) is not necessarily required
6. application of the principle of vertical measurement eliminates, e.g., drawbacks resulting from evaporation of the reaction mixture (Suovaniemi, Osmo: "Method for the

improvement of the dosage and measurement results of chemical analyses", U.S. Patent No. 4,144,030).

According to the present invention, in the  
5 analyzer it is possible to measure the cuvette-set matrixes (cuvette sets) in accordance with the two Finnish patent applications "Set of cuvettes" filed simultaneously with the present application in the simplest way so that into  
10 the analyzer first the cuvette-set matrix is placed onto a stationary radiation-source matrix and then the detector matrix is either shifted from elsewhere or pivoted onto the cuvette-set matrix.

The invention will be described in more detail below with reference to the attached drawing, wherein  
15 Figure 1 is a schematical presentation of an embodiment of the invention and

Figure 2 shows one cuvette and the source of radiation and the detector placed underneath and above the cuvette, respectively.

20 In Figure 1 an exemplifying embodiment of the invention is shown. The analyzer comprises a base 1, a frame 2, and a measurement head 8 permanently fixed to the frame, the said measurement head being provided with several optical fibres 9 functioning as sources of  
25 radiation. The detector matrix 3 is by means of the cable 4 connected to the apparatus. When the apparatus is not in use, the detector matrix 3 is fitted into a recess 18 in the frame placed at the side of the measurement head. The measurement takes place so that the cuvette set 7 is  
30 placed onto the measurement head 8 and that the detector matrix 3 is thereupon shifted onto the cuvette set. The detector matrix 3 may also be provided with hinges 5, which pivot in corresponding pieces 6 fitted to the frame. The detector matrix is in such a case pivoted around the  
35 hinges 5 onto the cuvette-set matrix 7, placed into the measurement head 8, for the time of the measurement and off the cuvette-set matrix after the measurement. During



the measurement, in this exemplifying embodiment, the beam of measurement comes vertically from the optical fibre 9 of each cuvette, placed in the measurement head, and passes through the corresponding cuvettes 10 placed in the cuvette-set matrix 7 to the detectors 11 in the detector matrix 5, the said detectors corresponding the said optical fibres 9 and cuvettes 10.

Figure 2 shows an optical fibre 9 and the bunch of measurement beams 13 departing from same and passing through the cuvette 10 in the cuvette-set matrix, corresponding the said optical fibre, vertically to the detector 11 in the detector matrix, corresponding both the said optical fibre and the cuvette. The optical window 16 of the cuvette 10 is placed in a plane different from the plane of the bottom 17 of the cuvette-set matrix, the optical window 16 placed higher than the bottom plane being retained as protected from fingerprints, scratches, and from dirt.

The invention is not confined to the above embodiment alone, but it may show even considerable variation within the scope of the patent claims.

It is evident that, according to the present invention, the cuvette-set matrix may also be measured in an analyzer embodiment in which the detector matrix is stationary or in which some component of the detector matrix moves in the measurement head. The cuvette-set matrix can be placed onto the detector matrix, and the measurement-beam matrix is shifted or pivoted onto the cuvette-set matrix, in which measurement-beam matrix there is a source of measurement signal of its own for each cuvette.

Besides the possibility that the cuvette-set matrix and the detector matrix or the measurement-beam matrix can be shifted manually, in the present invention the said shiftings and any other manipulations can also be performed automatically in the way most appropriate in each particular case. The measurement radiation may





also be produced by means of some appropriate wide source of radiation so that one or, at the maximum, few sources of radiation are required.



## WHAT IS CLAIMED IS:

1. An analyzer for the measurement of the properties of reaction mixtures contained in the cuvettes (10) in a set of cuvettes (7) simultaneously out of  
5 several cuvettes by means of one or several sources of radiation (9) placed above or underneath the cuvettes and by means of a detector (11) receiving radiation and placed underneath or above each cuvette, the beam of measurement passing substantially in the direction of the  
10 vertical axis of the cuvette and the set of cuvettes (7) being fitted to the apparatus detachably between the source or sources of radiation (9) and the detectors (11), either above the source or sources of radiation or above the detectors, c h a r a c t e r i z e d in that either  
15 the detectors (11) or the source or sources of radiation (9), respectively, can be shifted or fitted detachably or pivotably to the position of measurement above the set of cuvettes (7).
2. An analyzer as claimed in claim 1,  
20 c h a r a c t e r i z e d in that all the detectors (11) or the source or sources of radiation (9), respectively, can be fitted into the analyzer as one unit.



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Fig.1.

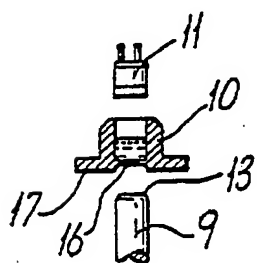
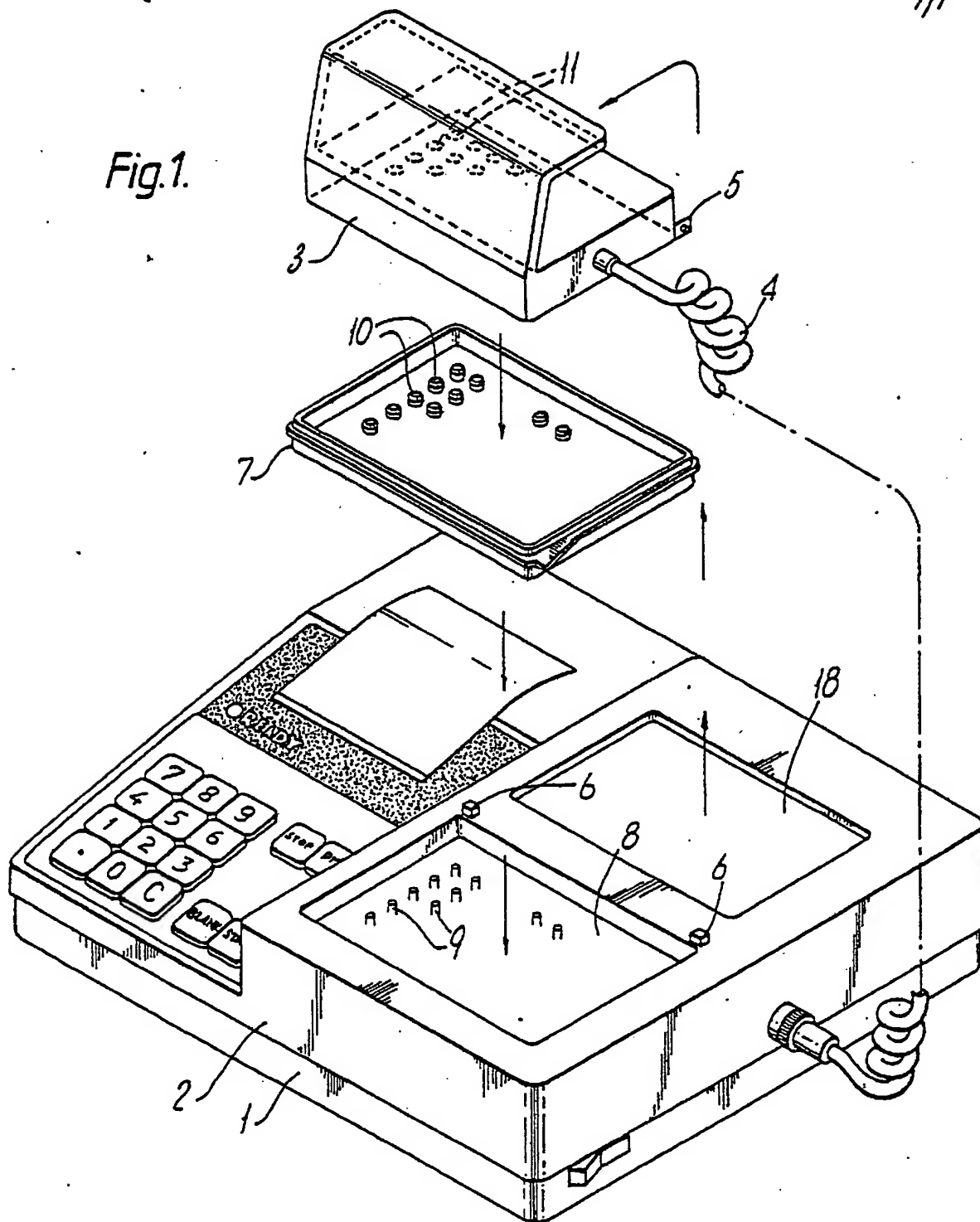


Fig.2.

SUBSTITUTE SHEET



# INTERNATIONAL SEARCH REPORT

International Application No PCT/FI81/00060

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>1</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <sup>3</sup> <p style="text-align: center;">G 01 N 21/01</p>																				
<b>II. FIELDS SEARCHED</b> <p style="text-align: center;">Minimum Documentation Searched <sup>4</sup></p> <table border="1"> <thead> <tr> <th>Classification System</th> <th>Classification Symbols</th> </tr> </thead> <tbody> <tr> <td>IPC 3</td> <td>G 01 N 21/01, 03, 11, 13, 15, 17, 25, 27, 55, 59, 84, 88, 90</td> </tr> <tr> <td>IPC 2</td> <td>G 01 N 21/22, 24, 32</td> </tr> <tr> <td>National CI</td> <td>42h:17/06</td> </tr> </tbody> </table> <p style="text-align: right;">.../...</p> <p style="text-align: center;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup></p> <p style="text-align: center;">SE, NO, DK, FI classes as above</p>			Classification System	Classification Symbols	IPC 3	G 01 N 21/01, 03, 11, 13, 15, 17, 25, 27, 55, 59, 84, 88, 90	IPC 2	G 01 N 21/22, 24, 32	National CI	42h:17/06										
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup> <table border="1"> <thead> <tr> <th>Category <sup>6</sup></th> <th>Citation of Document, <sup>16</sup> with Indication, where appropriate, of the relevant passages <sup>17</sup></th> <th>Relevant to Claim No. <sup>18</sup></th> </tr> </thead> <tbody> <tr> <td>A</td> <td>EP, A1, 0 012 698 published 1980, June 25, Merck &amp; Co. Inc.</td> <td></td> </tr> <tr> <td>A</td> <td>FR, A, 2 430 610 published 1980, February 1, Institut Pasteur</td> <td></td> </tr> <tr> <td>A</td> <td>DE, A1, 2 451 769 published 1975, May 15, Suovaniemi Osmo Antero</td> <td></td> </tr> <tr> <td>A</td> <td>US, A, 4 115 010 published 1978, September 19, McAleer William J. et al.</td> <td></td> </tr> <tr> <td>A</td> <td>US, A, 3 627 431 published 1971, December 14, Komarniski John Victor</td> <td></td> </tr> </tbody> </table>			Category <sup>6</sup>	Citation of Document, <sup>16</sup> with Indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>	A	EP, A1, 0 012 698 published 1980, June 25, Merck & Co. Inc.		A	FR, A, 2 430 610 published 1980, February 1, Institut Pasteur		A	DE, A1, 2 451 769 published 1975, May 15, Suovaniemi Osmo Antero		A	US, A, 4 115 010 published 1978, September 19, McAleer William J. et al.		A	US, A, 3 627 431 published 1971, December 14, Komarniski John Victor	
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<p><sup>15</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"a" document member of the same patent family</p>																				
<b>IV. CERTIFICATION</b> <table border="1"> <tr> <td>Date of the Actual Completion of the International Search <sup>1</sup></td> <td>Date of Mailing of this International Search Report <sup>1</sup></td> </tr> <tr> <td>1981-11-19</td> <td>1981-11-24</td> </tr> <tr> <td>International Searching Authority <sup>1</sup></td> <td>Signature of Authorized Officer to <sup>1</sup></td> </tr> <tr> <td>Swedish Patent Office</td> <td>Kristina Brandell</td> </tr> </table>			Date of the Actual Completion of the International Search <sup>1</sup>	Date of Mailing of this International Search Report <sup>1</sup>	1981-11-19	1981-11-24	International Searching Authority <sup>1</sup>	Signature of Authorized Officer to <sup>1</sup>	Swedish Patent Office	Kristina Brandell										
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## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

Continuation Fields Searched.

US C1

356: 179, 180, 186, 195-198, 201, 204-206, 208, 239, 240,  
244, 246, 335, 342, 343, 411, 426-428, 432-435,  
440-442

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>10</sup>

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... because they relate to subject matter <sup>12</sup> not required to be searched by this Authority, namely:

2. ☐ Claim numbers ..... because they relate to parts of the International application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out <sup>13</sup>, specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>11</sup>

This International Searching Authority found multiple inventions in this International application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International search report covers all searchable claims of the International application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this International search report covers only those claims of the International application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

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